

# Skagit Estuary IMW – Accomplishment Report

## Skagit Estuary Intensively Monitored Watershed Overview

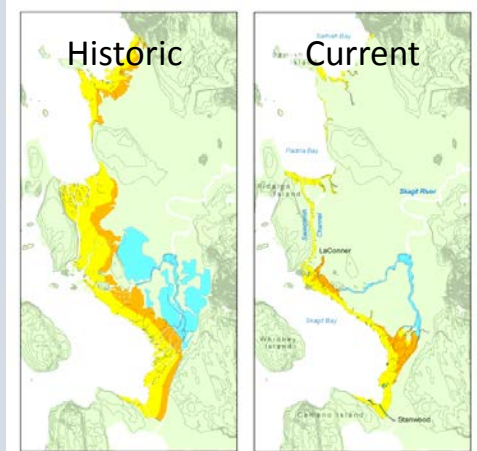
**Focal Species:** Chinook salmon (chum and coho also expected to benefit)

**Limiting factors:** Lack of estuary rearing area for juvenile Chinook; lack of access (i.e., connectivity) to estuary rearing areas. These limiting factors result in juvenile Chinook entering the marine environment before they are best suited to survive to adult.

**Restoration strategy:** Restore estuarine habitat extent; restore connectivity within the estuary.

### Experimental Design

- Within the Skagit estuary, we use BACI (Before-After-Control-Impact) designs to test for effects of estuary restoration upon the population. North Fork data are used as the control.
- We use BA (Before-After) designs to test for benefits of estuary restoration in the nearshore (the life stage following estuary rearing).
- Monitoring ongoing since 1994; restoration treatments began in 2001 and continue through present.



### Monitoring Approach

#### Chinook Salmon:

Sampling of fish occurs at five stages of the Chinook salmon life cycle:

- River outmigration: WDFW monitors outmigrants at Mt. Vernon daily (Feb-July).
- Estuary: SRSC monitors fish biweekly within N and S Forks (Feb-July).
- Intertidal shoreline: SRSC monitors fish biweekly in Skagit Bay (Feb-Sept)
- Subtidal surface waters: NWFSC monitors fish monthly in Skagit Bay (Apr-Oct).
- Adult returns: WDFW and tribes monitor escapement and estimate harvest. Data are used to estimate smolt-adult return rates (SAR).

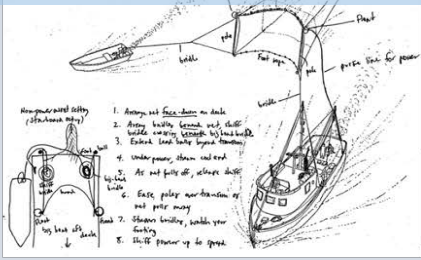
#### Habitat variables:

- Environment covariates (temperature, salinity, etc.) are measured at the time of fish monitoring.
- Estuary habitat extent and connectivity are measured through geographic information system (GIS) methods on 2-5 year intervals depending on the amount of restoration completed each year.

### Restoration Approach

- Process-based, with focus on restoring natural hydrologic (tidal, riverine) and sedimentation (fluvial & longshore sources) processes within the Skagit estuary.
- Restoring estuary habitat extent focuses on reconnecting historic estuary area to tidal/riverine hydrology to increase juvenile Chinook rearing carrying capacity.
- Restoring connectivity focuses on reconnecting tidal and distributary channels to estuarine wetland areas to improve efficiency of fish movement and prey resources within the estuary.

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## Restoration Accomplishments and Habitat Responses

Over the 20-year duration of monitoring:

- Overall, the Skagit estuary is gaining more habitat than it is losing with habitat restoration being the most important reason why (over 900 acres restored so far). Direct human causes of lost estuary extent have been minor.
- Natural gains and losses of estuary extent were also documented, with a net loss observed. The largest area of loss is along the bay front of Fir Island where the estuary is sheltered from river sediment deposition and more exposed to wave caused erosion.



## Fish Responses



### Local:

- *If you build it they will come.* Juvenile Chinook used restored habitat generally consistent with reference sites.
- *Some restoration designs work better than others for fish.* Projects using dike setback, dike breach, or fill removal worked best.

### Population level:

- Juvenile Chinook were less crowded in the estuary as restoration increased habitat opportunity.
- The length of fish residence in the estuary increased as restoration increased.
- More weakly supported include: a) reduced frequency of fry migrants in marine habitats and b) higher smolt-adult return rates as restored area increased.

## Future Direction

- Continued local and population level fish monitoring.
- Continued habitat monitoring. Restoration is ongoing in the Skagit estuary. A new restoration project (131 acres, Fir Island Farms) was completed in 2016 with the first fish rearing opportunity occurring in 2017.
- Implement BA design for a major connectivity project within the estuary (one project is in design stage).

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